

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 July and 30 September, 2004

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. During recent years there have been elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003; Garrison and Richards, 2004). As a result, a Biological Opinion on the pelagic longline fishery was recently developed by NOAA Fisheries under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the NED, with restrictions, on June 30, 2004 and similar restrictions were imposed upon the rest of the fleet effective August 5, 2004. This quarterly report includes fishing under both the old regulatory regime and the new regime.

The biological opinion requires quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirements and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from July 1, 2004 to September 30, 2004.

While it would be desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available until several months after the end of any given quarter. Therefore, I present the bycatch rate (i.e., catch per unit effort) based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate for each quarter and fishing area during 2004 is compared to that observed in 2003 and the average of the previous five years (1999-2003) to assess whether or not the observed rate in 2004 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 213 longline sets (~173,000 hooks) were observed during 3 of 2004 (Table 1). The Gulf of Mexico had the highest number of observed sets in both quarters. The Northeast Distant (NED) fishing area was reopened to pelagic longline fishery effort during this quarter after being closed since June, 2001. Fifty-six sets were observed in this reopened area comprising approximately 64,000 hooks (Table 1).

There were 20 observed interactions with leatherback turtles and 15 interactions with loggerhead turtles during this quarter (Table 2). The majority of marine turtles were recorded as being released alive and injured (Appendix A). The majority of interactions with both species were observed in the NED area (Table 2). The locations of observed sets and turtle interactions are shown in Figure 1.

There were a total of 4 marine mammal interactions observed including pilot whales, common dolphin, and a Risso's dolphin (Table 3). One pilot whale was determined to be seriously injured based upon the description of interactions with the fishing gear by the observer and established serious injury criteria (see Garrison, 2003), and the remaining marine mammals were released uninjured. Interactions with marine mammals were observed in the NED, MAB, and NEC regions (Figure 3).

The quarterly and regional bycatch rates are summarized for leatherback and loggerhead turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2003 and the average from 1999-2003 in Tables 6-7. Specific information on injuries to sea turtles and hook characteristics of each set are shown in Appendix A.

For leatherback turtles, the catch rate observed in the Gulf of Mexico was significantly lower than that observed during previous years in quarter 3. The relatively high interaction rate in the mid-Atlantic bight area for leatherbacks was unusual given that leatherbacks were reported taken in this area only rarely during the previous five years (Table 6a). The catch rate observed in the NED area was higher than that in 2003, but lower than the average over the previous five years. However, it is difficult to directly compare these rates as the fishery in the NED during 2001-2003 consisted of only experimental sets (Table 6a).

For loggerhead turtles, the bycatch rates in the GOM, MAB, and NEC were consistent with those observed in previous years (Table 6b). As with leatherback turtles, the catch rate for loggerheads in the NED was elevated compared to 2003, but lower than the previous 5 year average (Table 6b).

The bycatch rates for pilot whales (MAB area) and Risso's dolphin (NEC area) are consistent with those observed in previous years (Table 7). The third and fourth quarters in the MAB are the periods with consistently high interaction rates with pilot whales (Garrison, 2003; Garrison and Richards, 2004). The observed interaction with common dolphin in the NED was unusual compared to the previous five years.

In addition to reopening the NED area, the June 2004 biological opinion mandated the use of 16/0 or 18/0 circle hooks in the longline fishery. The observed distribution of hooks reflect this mandate, though J hooks were also used occasionally during this period (Figure 3a). This is in sharp contrast to the first two quarters of 2004 when the fishery consisted predominantly of 7/0 and 9/0 J hooks (Garrison, 2004). As a result, the majority of turtles were captured on circle hooks in the observed effort during quarter 3 (Figure 3b). Concerted efforts by fishermen to remove hooks and disentangle captured turtles are also mandated by the biological opinion. In 9 of 15 hooked leatherback turtles, the hook was successfully removed and no leatherbacks were released with entangling gear (Appendix A). In 8 of 15 captured loggerhead turtles the hook was successfully removed (Appendix A).

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review at the end of the 2004 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual fluctuations in bycatch rates and therefore estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

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- Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515: 52 p.
- Garrison, L.P. 2004. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery During January – June, 2004. SEFSC Document #PRD-03/04-10: 19 p.
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Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 July – 30 September, 2004 by fishing area.

Area	Sets	Hooks (x1000)
CAR	0	0
FEC	11	5.20
GOM	85	66.87
MAB	25	16.08
NCA	0	0
NEC	22	15.87
NED	56	63.54
SAB	14	4.84
SAR	0	0
TUN	0	0
TUS	0	0
Total	213	172.40

Table 2. Total observed interactions with leatherback and loggerhead Turtles in the U.S. Atlantic Pelagic Longline Fishery between 1 July – 30 September, 2004 by fishing area. All turtles were recorded as being released alive. Areas with missing values indicate no observer coverage during this time period.

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	0
GOM	4	1
MAB	3	2
NCA	-	-
NEC	0	4
NED	13	8
SAB	0	0
SAR	-	-
TUN	-	-
TUS	-	-
Total	20	15

Table 3. Interactions with marine mammals observed during 1 July – 30 September 2004 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and Demaster (1998) were used to evaluate serious injury.

Species	Region	Quarter	# Released Un-injured	# Dead	# Serious Injury
Common Dolphin	NED	3	1	0	0
Pilot Whale	MAB	3	1	0	1
Risso's Dolphin	NEC	3	1	0	0

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 July – 30 September, 2004 in the U.S. Atlantic Pelagic longline fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	11	0	0	-	-
GOM	85	4	0.0601	0.0009	0.50
MAB	25	2	0.1841	0.0183	0.73
NCA	0	-	-	-	-
NEC	22	0	0	-	-
NED	56	10	0.2315	0.0053	0.31
SAB	14	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	11	0	0	-	-
GOM	85	1	0.0130	0.0002	1.00
MAB	25	2	0.1493	0.0115	0.72
NCA	0	-	-	-	-
NEC	22	4	0.2888	0.0196	0.48
NED	56	5	0.1351	0.0046	0.50
SAB	14	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 July – 30 September, 2004 in the U.S. Atlantic Pelagic longline fishery. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury ?	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Common Dolphin	N	NED	1	56	0.01779	0.0003	1.00
Pilot Whale	Y	MAB	1	25	0.0552	0.0030	1.00
Pilot Whale	N	MAB	1	25	0.0696	0.0048	1.00
Risso's Dolphin	N	NEC	1	22	0.5348	0.0028	1.00

Table 6. Summary of quarterly bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 July – 30 September, 2004 and comparison to 2003 and the average rate from 1999-2003. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

A. Leatherback turtles

Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	-	-	-	-	-	-
FEC	0	-	0	-	0.0445	0.0091 – 0.2176
GOM	0.0601	0.0243 – 0.1490	0.1113	0.0448 – 0.2770	0.1456	0.0976 – 0.2174
MAB	0.1841	0.0526 – 0.6440	0	-	0.0174	0.0036 – 0.0853
NCA	-	-	-	-	-	-
NEC	0	-	0	-	0.0289	0.0086 – 0.0973
NED ¹	0.2315	0.1291 – 0.4153	0.1431	0.1078 – 0.1901	0.7485	0.4418 – 1.268
SAB	0	-	0.0914	0.0187 – 0.4467	0.2975	0.1315 – 0.6728
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	-	-	-	-	-	-
FEC	0	-	0	-	0	-
GOM	0.0130	0.0027 – 0.0633	0.0455	0.0136 – 0.1518	0.0150	0.0054 – 0.0417
MAB	0.1493	0.0437 – 0.5098	0.0279	0.0057 – 0.1363	0.1407	0.0614 – 0.3226
NCA	-	-	-	-	-	-
NEC	0.2888	0.1203 – 0.6934	0.2102	0.0904 – 0.4889	0.2452	0.1547 – 0.3884
NED ¹	0.1351	0.0549 – 0.3327	0.0719	0.0479 – 0.1079	0.7820	0.5062 – 1.208
SAB	0	-	0	-	0.0620	0.0127 – 0.3031
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

¹ Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from “normal” fishery operations.

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 July – 30 September, 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Area	Species	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
MAB	Common Dolphin	0	-	0.0347	0.0071 – 0.1694	0.0136	0.0028-0.0667
MAB	Risso's Dolphin	0	-	0.0270	0.0553 – 0.1321	0.0106	0.0022-0.052
MAB	Pilot Whale	0.1247	0.0376 – 0.4140	0.1458	0.0567 – 0.3749	0.1328	0.0631-0.2795
NEC	Common Dolphin	0	-	0	-	0.0282	0.0058-0.1377
NEC	Risso's Dolphin	0.0535	0.0109 – 0.2614	0.0500	0.01023 – 0.2445	0.0148	0.003-0.0723
NEC	Pilot Whale	0	-	0	-	0.0163	0.0033-0.0797
NEC	Unid. Whale	0	-	0	-	0.0169	0.0035-0.0825
NED ¹	Unid. Dolphin	0	-	0	-	0.0026	0.0008-0.0089
NED ¹	Common Dolphin	0.0178	0.0036 – 0.0869	0	-	0.0012	0.0002-0.006
NED ¹	Risso's Dolphin	0	-	0.0081	0.0033 – 0.0199	0.0146	0.0077-0.0276
NED ¹	Striped Dolphin	0	-	0.0020	0.0004 – 0.0096	0.0009	0.0002-0.0043
NED ¹	Unid. Mammal	0	-	0	-	0.0012	0.0002-0.0057
NED ¹	Baleen Whale	0	-	0.0024	0.0004 – 0.0116	0.0011	0.0002-0.0053
SAB	Risso's Dolphin	0	-	0	-	0.1219	0.0366-0.4059

¹ Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from “normal” fishery operations.

Figure 1. Observed Pelagic Longline effort (light gray) and turtle (symbols) interactions during 1 July – 30 September, 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

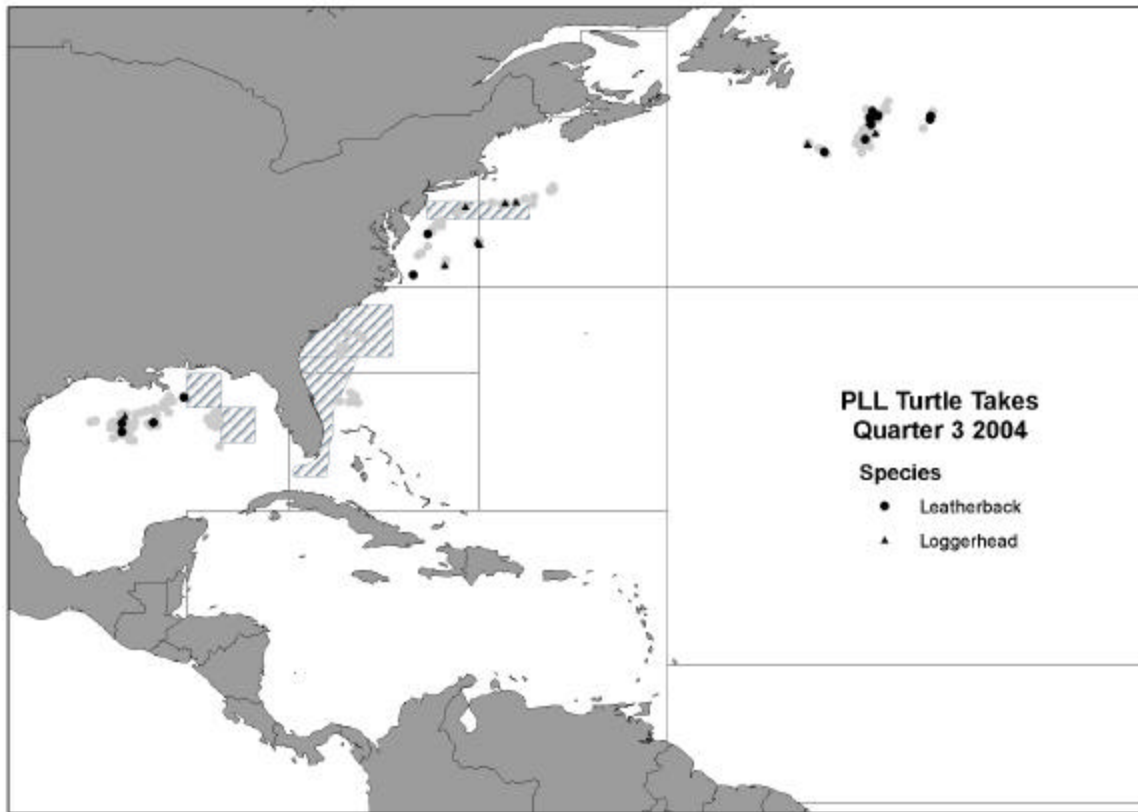


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 July – 30 September, 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

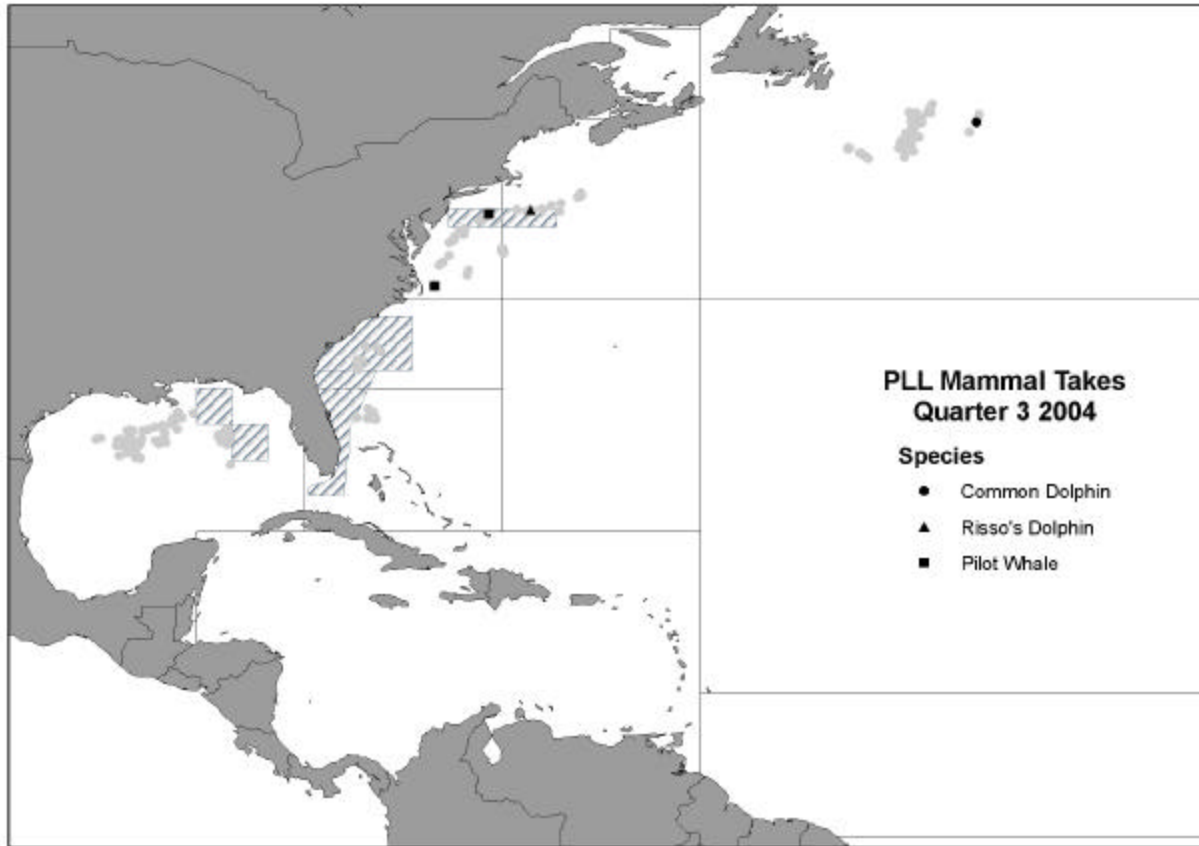
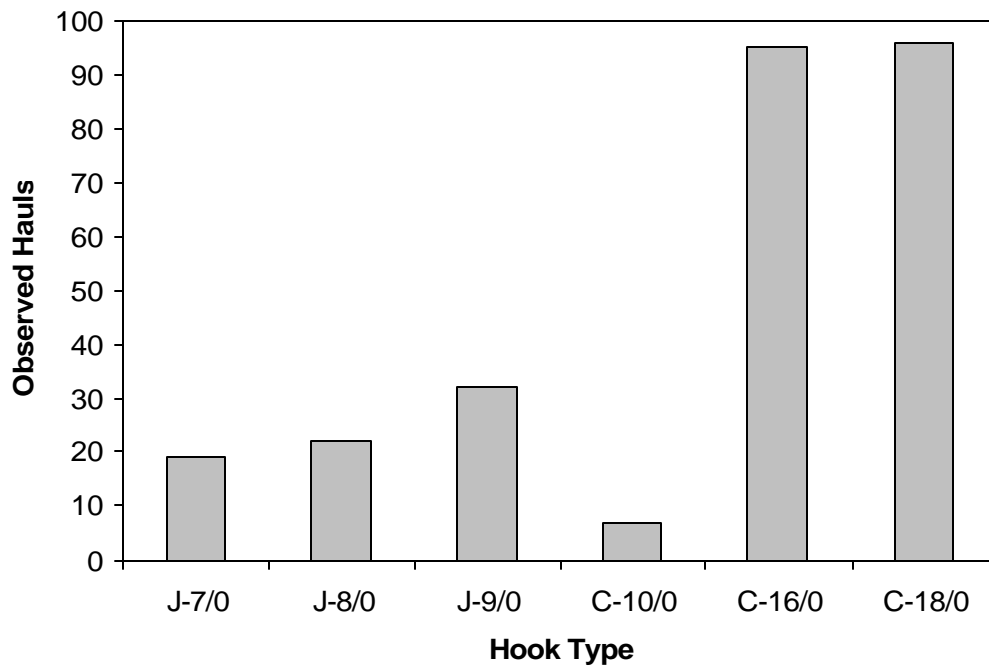
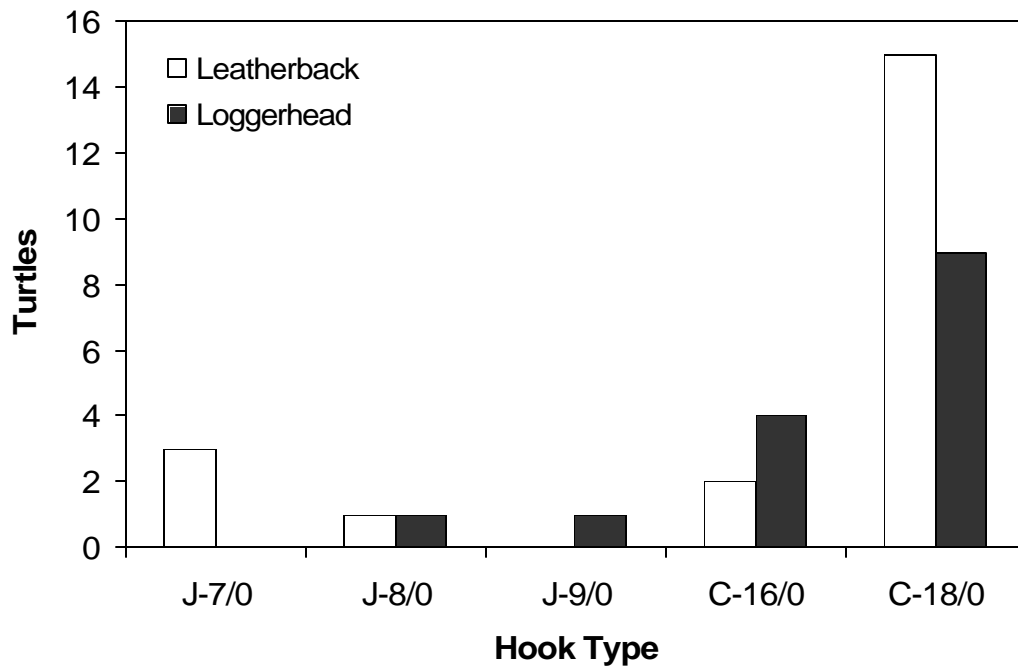


Figure 3. (A) Hook sizes and types observed in the pelagic longline fishery during quarter 3 of 2004 and (B) the number of turtles captured by hook type. In some cases, multiple hook types were reported in the same sets.

A.



B.



Appendix A: Injury details and hook type for turtles captured in the pelagic longline fishery during 1 July – 30 September, 2004. The hook type indicates the shape (“J” = j type, “C” = circle type) and size of hook that captured the turtle.

A. Leatherback Turtles

#	Fishing Area	Hook Type	Offset (degrees)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	GOM	C- 16/0	0	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	3.00		
2	MAB	C-18/0	10	Alive, uninjured	armpit	na	na	no	yes	no	0.00	5.00		
3	MAB	C-18/0	10	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	6.00		
4	GOM	J-7/0	0	Alive, injured	armpit	na	na	no	no	no	0.50	4.00		
5	GOM	C- 16/0	0	Alive, injured	armpit	na	na	no	no	no	10.00	6.00		
6	MAB	J-8/0	10	Alive, injured	shoulder	na	na	no	yes	no	0.00	4.00		
7	GOM	J-7/0	0	Alive, injured	front flipper /shoulder/armpit	na	na	no	no	no	3.00	4.00		
8	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	no	no	0.00		152.4	
9	NED	C-18/0	10	Alive, injured	armpit	na	na	yes	no	no	0.00	5.00		
10	NED	C-18/0	10	Alive, uninjured	not hooked	na	na	na	yes	no	0.00		151.8	
11	NED	C-18/0	10	Alive, uninjured	not hooked	na	na	na	yes	no	0.00		150	
12	NED	C-18/0	10	Alive, injured	front flipper	na	na	yes	no	no	0.00	5.00		

#	Fishing Area	Hook Type	Offset (degrees)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
13	NED	C-18/0	10	Alive, injured	armpit	na	na	yes	yes	no	0.00	5.30		
14	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	yes	no	0.00		146.2	
15	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	yes	no	0.00		147.8	
16	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	yes	no	0.00		143.6	
17	NED	C-18/0	10	Alive, injured	armpit	na	na	yes	no	no	0.00	5.00		
18	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	no	no	0.00		152.6	
19	NED	C-18/0	10	Alive, injured	armpit	na	na	no	no	no	0.00	4.50		
20	NED	C-18/0	10	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	5.00		

B. Loggerhead Turtles

#	Fishing Area	Hook Type	Offset (degrees)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	GOM	C- 16/0	0	Alive, injured	beak internal	lower	na	yes	no	no	0.00		68	62.6
2	NEC	J- 9/0	Unk	Alive, injured	swallowed	na	not visible	no	no	no	0.20		71.1	
3	MAB	C- 16/0	0	Alive, injured	mouth	lower other	na	no	no	no	0.00		66	59

#	Fishing Area	Hook Type	Offset (degrees)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
4	NEC	C- 16/0	0	Alive, injured	mouth	lower other	na	yes	no	no	0.00		72.2	65.8
5	NEC	C- 16/0	0	Alive, injured	mouth	lower other	na	yes	no	no	0.00		66	60.1
6	NEC	Unk	Unk	Alive, injured	swallowed	na	not visible	no	yes	no	0.20		76	68.1
7	NED	C-18/0	10	Alive, injured	shoulder	na	na	yes	yes	no	0.00		70	60.3
8	NED	C-18/0	10	Alive, injured	swallowed	na	partial hook	no	no	no	0.30		72	63.7
9	NED	C-18/0	10	Alive, injured	tongue	lower	na	yes	no	no	0.00		67.9	60.9
10	NED	C-18/0	10	Alive, injured	beak internal	lower other	na	yes	no	no	0.00		66.2	57.9
11	NED	C-18/0	10	Alive, injured	beak internal	unk	na	yes	no	no	0.00		59.8	53.5
12	NED	C-18/0	10	Alive, injured	rear flipper	na	na	no	no	no	0.00		64	57.2
13	NED	C-18/0	10	Alive, injured	glottis	lower	na	no	no	no	0.00		69	60.9
14	NED	C-18/0	10	Alive, injured	mouth	lower other	na	yes	no	no	0.00		69.5	62.1
15	MAB	C-18/0	10	Alive, injured	beak internal	lower	na	no	no	no	0.10	2.5		